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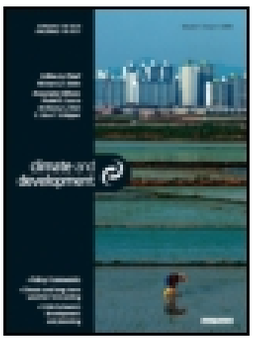

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Beyond Technical Fixes: climate solutions and the great derangement

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ABSTRACT

Climate change research is at an impasse. The transformation of economies and everyday practices is more urgent, and yet appears ever more daunting as attempts at behaviour change, regulations, and global agreements confront material and social-political infrastructures that support the status quo. Effective action requires new ways of conceptualizing society, climate and environment and yet current research struggles to break free of established categories. In response, this contribution revisits important insights from the social sciences and humanities on the co-production of political economies, cultures, societies and biophysical relations and shows the possibilities for ontological pluralism to open up for new imaginations. Its intention is to help generate a different framing of socionatural change that goes beyond the current science-policy-behavioural change pathway. It puts forward several moments of inadvertent concealment in contemporary debates that stem directly from the way issues are framed and imagined in contemporary discourses. By placing values, normative commitments, and experiential and plural ways of knowing from around the world at the centre of climate knowledge, we confront climate change with contested politics and the everyday foundations of action rather than just data.

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Introduction

Across the globe, scholars, activists and concerned people are decrying the lack of effective action on climate change. Despite decades of warnings over dangerous levels of greenhouse gases in the atmosphere and disturbing variations in ecosystems, emissions have increased rather than decreased. The task of transforming economies and everyday practices has become more urgent than ever, and yet more daunting as attempts at behaviour change, regulations, and global agreements confront the realities of material and social-political infrastructures that support the status quo. Indeed, it is at least in part this confrontation between climate responses and social-political realities that creates inaction.

Growing frustration has inspired researchers to propound the need to live within planetary boundaries (Steffen, Grinevald, Crutzen, & McNeill, 2011), focus on politics and social relations (Leichenko & O'Brien, 2008; Taylor, 2013), and design major transformations in development pathways, knowledge systems and science policy-interactions (Castree et al., 2014; Klenk, Fiume, Meehan, & Gibbes, 2017; O'Brien, 2013). While these approaches are quite different, they all point to how intrinsic the climate problem is to modern life. The dangers are not simply lack of action, but also that we do not know *and cannot know* exactly what changes – including thresholds and feedbacks – are in motion (Hulme, 2018). And yet, research continues to be driven by demands to identify more precisely the levels of risk and for whom (O'Brien, Eriksen, Nygaard, & Schjolden, 2007). This desire for more accurate assessments is not only problematic in the face of the insurmountable uncertainties around climate change, but also, ironically, contributes to limiting the knowledges brought to bear on the climate problem. Limiting knowledge not only shuts down potential solutions, but also generates a variety of social justice concerns. In this think-piece we seek to illuminate how innovative ways of imagining climate change and the relationship between society and environment can give rise to socially just, effective action.

The novelist Amitav Ghosh (2016) terms the failure to reimagine humans' place in the world, the 'Great Derangement'. This Great Derangement is founded upon a dualistic conceptualization of the world in which social and environmental processes are conceived as separate yet interacting forces,

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pointing towards a set of largely technical solutions for policy and practice (Merchant, 1982). By technical, we mean responses that impart new infrastructures or that seek to create biophysical changes; examples which vary in emphasis and across scales from water control infrastructures such as irrigation, drinking water and dams, to tree plantations, or geoengineering for carbon sequestration. While the vocabulary of impacts, adaptations, emissions and mitigation has become firmly embedded in the policy sphere, we believe this framework conceals ways of knowing that might help more effectively address the climate predicament and foster determined action.

By revisiting important insights from the social sciences and humanities around the co-production of knowledge, political economies, cultures, societies and biophysical relations, we seek to redirect current thinking on how to respond to climate change. While calls for transformative change are getting louder (O'Brien, 2018; Pelling & Garschagen, 2019), we argue that the failure to act systemically on these calls stems from the ways we frame climate change itself. Our thoughts are organized around several moments of 'concealment' within academic and policy debates in order to show how rethinking the climate problem itself opens up new possibilities for action.

Fundamentally, we show how the overemphasis on parsing *identifiable* and *external* climatic threats (Noble et al., 2014), rooted in a conceptual separation of nature from society, limits our abilities to imagine other futures and perpetuates the status quo. At the heart of this dualism is the notion that we can separate out the 'climatic' drivers of change from 'social' ones, therein creating a set of policies to deal with climate change – adaptation and mitigation – in isolation from the broader trajectories of socio-environmental change. This is not only scientifically impractical, because there are no sound conceptual grounds for this separation, it is also politically charged. Parsing out supposedly climatic drivers of change might help make climate change a more governable phenomena in the short-term, but it leads to an impoverished understanding of the ways that environmental change is embedded within social change (Leach, Scoones, & Stirling, 2010; Leichenko & O'Brien, 2008; Nightingale, 2018; Ockwell & Byrne, 2016; Stirling, 2015). In particular, it marginalizes core questions of how the opportunities of the few often stem directly from the new vulnerabilities of others – including future generations and non-human species (Forsyth, 2014; Ribot, 2014; Taylor, 2015).

Thus, in order to foster socially-just pathways for change we need to take a critical approach to knowledge that recognizes how the issues we are trying to solve are also products of the way they are framed in the first place and the power relations they reflect. Our primary contention is that rethinking the way humans actively produce climate will entail replacing adaptation, mitigation and 'human impacts' as central concepts with more nuanced, plural conceptualizations of the co-emergence of societies and global climate change.

The technical trap

The world of adaptation and mitigation has for too long been mapped in terms of a social cartography of vulnerabilities to climate to be remedied by building adaptive capacity, forging resilience, capturing carbon, and so forth. This produces a science-policy interface that is absorbed with identifying threats and responding to impacts in order to create transformative change. As a result, the adaptation concept slips insistently to technological measures, despite widespread acknowledgement of their pitfalls (Adger, Lorenzoni, & O'Brien, 2009; Boyd, 2017; O'Brien & Selboe, 2015). Truly transformative change – founded on change in knowledge systems and the opening of deliberative space for defining futures – fails to gain traction.

The slippage originates in the wider framing of climate change as an external threat to (separate) natural and human systems, coupled to adaptation policy decisions informed by best science, both of which cannot challenge existing political economic systems (Aldeia & Alves, 2019; Ojha et al., 2015; Pelling, 2011; Taylor, 2015). Seeking complete understanding ironically subsumes other ways of knowing that are embedded within lived experiences, cultural memories, and the arts (Goldman, Turner, & Daly, 2018; Gyawali & Thompson, 2016; Tsing, Swanson, Gan, & Bubandt, 2017), blocking our abilities to imagine differently how we can live with uncertainty and rapid rate change. While no author would contest the need for good science, it is patently clear that more evidence is not sufficient to inspire action or reframe policy processes (Hulme, 2018). Instead, the quest to understand impacts has either over-simplified complex climate-society dynamics, or takes the 'non-climatic' for granted. Within such a limited framing, moments of concealment are created.

First, the separation of mitigation from adaptation in order to evaluate the extent of the problem and clarify levels of danger is underpinned by the assumption that climate change is a stressor external to society. Mitigation – the reduction of atmospheric greenhouse gas concentrations creating global warming, including reducing emissions and carbon sequestration – and adaptation – adjustments for reducing the negative effects – preoccupy scientific and policy attention in global commitments and scientific assessments (Pielke, 1998). This preoccupation is carried forward in assessment methods such as 'detection' and 'attribution' that link climate change as an external threat to identifiable impacts on social and environmental systems, despite the huge uncertainties in attempting to do so. By holding these processes separate, the ways in which climate change is both a product of and complicit in producing political economies, cultural practices, knowledges as well as ecosystems is obscured (Crate & Nuttall, 2016; Eriksen, Nightingale, & Eakin, 2015; Naess et al., 2015; Nightingale, 2016; Pelling, 2011).

The emphasis on detection and attribution, however, also reflects a more fundamental conceptual framing that holds society and environment as two separate, interacting domains. This framing has been extensively critiqued on the basis that it is not only ontologically inaccurate, because society is not a discrete domain from nature, but also that retaining the divide for analytical purposes obscures how societies and environments are co-emergent (Barad, 2007; Haraway, 1991; Jasanoff, 2013). In other words, humans do not stand outside their environments but are active protagonists in their production, including of course the production of climate and our knowledge of it.

Second, recent conceptualizations, including the IPCC assessments, have tried to remedy these problems by focusing

on climate risk and its management (IPCC, 2012), ostensibly to respond to both environmental risks and inequality dynamics. Yet, risk research implicitly remains premised on physical climate stress, again pushing adaptation programmes towards technological solutions such as disaster risk reduction, infrastructure, technology, and changing everyday practices (Agrawal & Perrin, 2009; Magnan et al., 2016; Vincent, Naess, & Goulden, 2013). Research in South Asia has shown, for example, that uncertainty and risk framings by planners and policy makers at global and national levels lead to techno-managerialist solutions which have little to do with the experiences and lived realities of people at local levels, especially in the Global South (Gyawali & Thompson, 2016; Mehta et al., in press). As a result, these efforts fall short of locating climate change within political economy, multiple stressors, contextual vulnerability and governance, despite decades of research showing the importance of doing so (Bohle, Downing, & Watts, 1994; Liverman, 1990; O'Brien et al., 2007; Pelling & Garschagen, 2019; Ribot, 2014; Taylor, 2015). A key reason for this, once again, is that attempts to engage intermeshed social-environmental dynamics falter on dualistic conceptualizations that limit thinking about how societies and environmental change are co-produced. They strive, in short, to avoid the messy realities that would challenge established forms of governance and policy making.

As a result of these two moments of concealment, critical interventions either fail to shape international debates and overturn the technical focus of climate interventions, or are incorporated into fundamentally different models of how society works. Thus, many have argued that climate change scholarship is dominated by a narrow strand of social science, largely excluding the humanities, critiques from political ecology, and similar debates (Castree et al., 2014; Goldman et al., 2018; Hackmann, Moser, & Clair, 2014; Klenk & Meehan, 2015). The question is therefore how to reimagine the climate dilemma and embed a political understanding in the climate change field.

Co-production of socio-natures

Reconceptualizing society-environments is no simple task. Our argument is not asking for more knowledge, or better knowledge integration, rather we open up framings to make room for plurality of knowledges (Goldman et al., 2018; Nightingale, 2016; Stirling, 2015), normative debates and affective understandings (Klenk & Meehan, 2015; Pettenger, Kirton, Schreurs, & Von Moltke, 2013; Singh, 2013). It is precisely these ways of knowing – and more profoundly alternative imaginations of humans' place in the world – that Ghosh appeals to as offering one way out of the Great Derangement (see also Head & Gibson, 2012; Klenk et al., 2017; Tsing et al., 2017). Ontological pluralism requires scholars to radically rethink the scientific method and its propensity to isolate and reduce problems to observable phenomenon. Rather, alongside well-honed scientific approaches, scholars have to hold different ways of knowing as equal, query the discontinuities and contradictions that viewing the climate problem through different knowledges produces, and embrace the uncertainties that arise. In this section we explore several more moments of concealment to begin opening up the debate.

Ontological plurality goes beyond much current discussion of co-production and local knowledge in environmental and climate science (Harvey, Cochrane, & Van Epp, 2019; Jasanoff, 2013; Miller & Wyborn, 2018). In environmental science, co-production refers to a cognitive process of consultation with stakeholders in order to integrate users' definitions of problems better. This has been used in climate change research to integrate local or indigenous knowledges and to make adaptation interventions more relevant (Fazey et al., 2007; Klenk et al., 2017). While such initiatives are welcome, science and technology studies (STS) go beyond cognitive processes to recognize how knowledge is shaped simultaneously with social relations and visions of social order (Jasanoff, 2013). STS scholars argue that truth claims made about the world are intrinsically linked to the values, objectives, and problems experienced by those who create it – including their relations with non-human species and processes. Put differently, if people play divergent roles in the co-production of environments, and are unevenly empowered or disempowered by the outcomes, they will typically develop radically different understandings of processes that build from irreconcilable ontological and normative foundations. Simply adding different knowledges together misses the fundamentally political nature of all knowledge formation.

Such approaches to co-production therefore emphasize the relations, norms and politics through which users adopt knowledge as legitimate and authoritative (Harvey et al., 2019). These insights do not imply that the problems referred to by science are imagined, but rather that the processes of generating scientific knowledge about complex problems are inevitably and often invisibly embedded in society. We therefore advocate for an approach to climate problems that seeks to reveal these normative, political, embodied (in humans and non-humans) and ultimately contested processes of knowledge production. To do so, we must ask critical questions about how climate problems are framed and by whom, and how they are adopted as authoritative (Hulme, 2014). These questions, we suggest, could well lead to rejecting the concept of adaptation all together in favour of an alternative that can better capture socionatural dynamics.

One example of reframing has come from Pelling (2011) and others who have insisted that climate change is a problem produced by modern political economies, drawing our attention to industrial practices and economic flows that culminate in dangerous emissions (Ockwell & Byrne, 2016). Areas of the world where emissions are produced and scientific inquiry is concentrated are not simply by-products of our political economy, they are productive of it. From this perspective, we need to address why society is geared towards a high-consumption, high-emissions mode of production in the first place. But when we think about these insights in a more profoundly co-productionist frame, they lead us to also examine climate change in order to understand capitalism itself. New questions about how the global economy operates over time and space emerge by examining the vulnerabilities, risks and biophysical transformations identified by climate science. In other words, climate change can tell us something about capitalism, as well

as climate change being an outcome of capitalist processes. Through such a reframing, we can move beyond the 'technical fixes' and 'capitalism is the cause' impasse and open up a much broader reflection on how we understand our place in the world.

Framing is perhaps the most foundational moment of inadvertent concealment within climate change science as it allows some questions to be asked and others to be edited out (Goldman et al., 2018; Haraway, 1997; Jasanoff, 2013; O'Brien et al., 2007). Conceptualizing climate change as a biophysical problem primarily driven by carbon emissions, for instance, has fuelled research on 'putting carbon back in the ground', allowing the continuing emission of carbon into the atmosphere as part of a global accounting mechanism. The imagination of carbon budgeting has shifted research attention to biological and geological processes of carbon capture and storage, which while not the intention of most scientists involved, effectively vindicates existing modes of capitalist consumption and use of energy and emissions-intensive production and consumption processes. In contrast, the above framing of climate change as a problem derived from carbon-based energy systems and quests for political and human security, puts the capitalist political economy as the central object of analysis (Pelling, 2011).

As a think-piece, this is not the place to explore these debates more substantively; rather their juxtaposition illustrates how very different research priorities emerge when ontological plurality is applied (Goldman et al., 2018; Nightingale, 2016). Their contradictions help expose the co-production of values, social relations and environmental change that differ across disciplines and political communities. Taking climate change as a co-produced issue makes framings more accountable, transparent and open to scrutiny from other ways of knowing. And while there are many scientists who use carbon budgets precisely to argue against the current carbon intensive economy (Anderson, Stoddard, & Schrage, 2017), our point here is that the imagination of climate change as a problem of emissions derives from values and social relations that are overwhelmingly embedded within the status quo of a global capitalist economy predicated upon the intensive use of carbon-based energy forms. We therefore should not be surprised that carbon budgeting is unable to motivate the urgent decarbonization of that very system.

Furthermore, reconceptualizing climate change in terms of socionatures requires accounting for processes that are in flux as we attempt to understand and address them. Societies themselves – and environments – change as people map and react to climate impacts. If we accept this proposition, then looking for the impacts of climate change in terms of predictable shocks and stresses becomes a problematic exercise; what is required instead is to look for dynamic change. Adaptation activities, for example, change the kind of contributions to carbon emissions that 'adapting people' make, shifting the very problem they attempt to solve. So, while the effects may not be immediately obvious for individuals and communities, on a wider scale, if adaptation efforts are successful, then climate change itself – and thus what adaptation needs are – also shift.

Current attempts to capture such dynamic change through resilience frameworks are constrained by their underlying biophysical science assumptions (Cote & Nightingale, 2012; Cretney, 2014). While resilience and other frameworks are useful for holding dynamic contexts in view (Turner et al., 2003; Walker, Anderies, Kinzing, & Ryan, 2006), they fall short of making politics and social relations pivotal to how system dynamics unfold, and as a result, at best provide a partial entry point to the current task (Brown, 2015; Cannon & Müller-Mahn, 2010; Forsyth, 2018). We therefore need to continue to push the boundaries of socionatural conceptualizations and methodologies to grasp dynamic change (Savransky & Stengers, 2016; Scoones, 2016; Tschakert et al., 2016).

At the heart of the co-production of socionatures stands the issue of uncertainty. Knowledge about climate change is rife with unknowns (Adam, Mehta, & Srivastava, 2018; Hulme, 2018), driving a global research apparatus committed to collecting more data, integrating across disciplines, filling gaps, and modelling processes that we cannot directly observe. Once again, while we unequivocally do not reject these efforts or the understanding they reveal, we are also concerned about what they conceal. They are premised upon the notion that more knowledge will lead to better responses and result in the science-policy-behavioural change pathway we criticized earlier.

Accepting uncertainty within the co-production of socionatures leads us to suggest that integration of knowledge does not help us reframe the problem of climate. Instead, integration risks subsuming and depoliticizing the values and social relations through which different ways of knowing are authorized and accepted as valuable for responding to climate change (Crate & Nuttall, 2016; Stirling, 2015), and therefore the kinds of socionatures that are possible. If, following Ghosh (2016) and others (Klenk & Meehan, 2015; Raffles, 2002; Scoville-Simonds, 2018; Singh, 2018; TallBear, 2011), we embrace indigenous, embodied and experiential knowledges, and affective ways of knowing, then uncertainty is more of a concern when singular (as opposed to plural) framings are propounded, and imaginations are impoverished by attempting to isolate causality or collect more data on what is inherently unknowable. Plural framings offer better possibilities to deal with the multiple uncertainties of climate change. We therefore advocate holding in tension the imaginations, affects, experiences and social relations of people across scales as crucial starting points for different responses to climate change. These starting points actively work with uncertainty and ignorance – recognizing their dynamic and constitutive role in the climate problem – rather than trying to fill gaps.

This discussion brings us to another moment of concealment within climate research. There is a tendency to avoid the thorny maze of ontological inconsistencies to find convenient frameworks that can more easily accommodate current thinking. This is true for both biophysical and social science. Inconsistencies arise from profoundly different conceptions of the world across ways of knowing. Resilience frameworks and critical social science frameworks of power are a case in point. They fundamentally conceptualize the mechanisms of social change differently, resulting in very different approaches to accounting for power in on-the-ground projects (Cote & Nightingale, 2012; Cretney, 2014; Forsyth, 2018; Shove, 2010). In another example, ontological frictions were evident in responses to drought among the Masai in east Africa.

Intermingled social, ecological, political and economic responses to changes in precipitation meant that Masai experienced drought in different times and places than the scientific-technical evaluations of east African drought, with significant consequences for the effectiveness of interventions intended to support the Masai (Goldman, Daly, & Lovell, 2016). Climate science, despite the emphasis on interdisciplinarity, thus is characterized by a partitioning of expertise and also exclusion of ways of knowing that are assumed *a priori* to be irrelevant (Hulme, 2014). In contrast, we must remain more cognizant of ontological inconsistencies and probe the gaps in our knowledge that emerge from them, as well as how they point to what is unknowable. The contradictions and discontinuities in knowing that arise in an ontologically plural approach reveal starting points that can go beyond not only current climate science, but also indigenous and local knowledges, none of which in isolation are up to the task.

Global climate change as an object of analysis has produced an entire scientific and policy apparatus scaled globally (Bulkeley, 2012; Hulme, 2010). This brings us to another moment of concealment. Scale is a concept that seeks to describe relationships in a proportional manner. While often a product of observed relationships, scale itself – and the levels that are defined in relation to different scales – are social, political and technological constructs (Lebel, 2006). One consequence of investing so heavily in climate as a global problem, is that solutions also have been largely conceived and constrained by their global framing (Tanner & Allouche, 2011).

Now that more attention has turned to adaptation, another moment of inadvertent concealment has emerged: climate models that work at global scales are not easily merged with models that generate scenarios at smaller scales, nor with social science understandings of socionatural change. These dilemmas are driving calls for more regional and local level data and new modelling techniques. Again, we are not arguing against such efforts, but we want to make two points. One, the framing of climate change as global has impoverished the ability to understand climate change at the level at which people experience it: regional and local variation (Rosengren, 2018; Tang & Dessai, 2012). And, two, more profoundly, such a framing has privileged technical science and ways of knowing within international policy domains that encompass the global, and climatic time scales, often editing out, or at least marginalizing research and ways of knowing that are more focused on climate and people's everyday lives within international policy domains (Bezner Kerr et al., 2018; Crate & Nuttall, 2016; Goldman et al., 2016). And while there is a burgeoning sphere of local adaptation projects and research intent on extracting local knowledges for global climate science (Klenk et al., 2017; Schipper, Ayers, Reid, Huq, & Rahman, 2014), such work has not profoundly challenged the ontological foundation of climate change as a global phenomenon for research and policy.

Unpacking the scaling of climate as a global problem further reveals how knowledges of climate change are co-productive of who is authorized to govern environmental change (Bulkeley et al., 2012; Nightingale, 2017). For the past twenty-five years this has meant that the UNFCCC often directs national governments' climate efforts, and national governments are expected to oversee sub-national efforts. At the same time, the separation of adaptation (response) from mitigation (reducing emissions) has placed a lot of responsibility for managing change within localities where those changes are experienced. So while mitigation carries a normative imperative to coordinate global efforts for the good of all, adaptation is assumed to be a problem for local people – by building capacity or developing resilient livelihoods, albeit with some international financial support (Barrett, 2014) – that fails to challenge the system creating the need to adapt (Ribot, 2014; Taylor, 2015). In this way, the climate problem is characterized by governance decisions at one level with management outcomes at another (Arora-Jonsson, Westholm, Temu, & Petitt, 2016; Mehta et al., in press). The displacement of responsibilities combined with framing society as external to global environmental change makes it more amenable to governing in terms of discrete and managed processes. Climate change becomes something abstract and separate from people's lives and from societal change.

Instead, efforts need to be placed on understanding how the climate challenge itself is imagined differently when we change the scale at which it is assumed to operate and the knowledges needed to understand it. Such an ontological shift reveals new actors capable of governing change and suggests new kinds of responses that build from the frictions generated by a global apparatus intended to support adaptation and mitigation, and the realities of who has to adjust. By taking uncertainty as a starting point in this manner, and supporting people to embrace the unknown, rather than something to be controlled or mitigated against, creative, plural responses to climate change can become an engine of radical transformation.

Conclusion: justice and change

Throughout this think-piece we have discussed how the current framing of global climate change and the scientific-policy apparatus built to tackle it limit our imagination and narrow the range of potential responses. Together, they have influenced the expertise that is brought to bear, the questions that can be asked, the people assumed to need assistance, versus those with important knowledge to govern change, and the scales at which responses should be organized. The socionature framing we have used allows us to see climate change and vulnerability as produced by our current political economic system and the injustices that are inflicted on people. Even if a specific perpetrator or event cannot be identified, uneven power relations and knowledge processes allow these injustices to happen or even play an active part in producing them (Scoones, 2016). This discussion brings us to our final point: if climate change is co-produced with society, it is also co-produced as an object of social justice (Ziervogel et al., 2017).

We have already alluded to some of the ways this occurs. First, conceptualizations of the climate problem are embedded within the politics of whose interests are prioritized and whose knowledges are considered legitimate for addressing climate change (Beck, 2012; Hulme, 2010; Nightingale, 2017). These are not innocent processes of determining which scientific findings are best. Rather, the scientific questions asked and the areas of the globe analysed reflect global geopolitics (Beck et al., 2014; Dubash & Rajamani, 2010), values and social

relations (Jasanoff, 2013; O'Brien, 2013), and economic hegemonies (Pelling, 2011). The IPCC reports have been heavily criticized by some developing countries for failing to provide equal coverage of the globe in their proclaimed global assessments, or for failing to acknowledge how climate risks are experienced as different problems in different places (Agarwal & Narain, 1991; Agrawala, 2005; Kandlikar & Sagar, 1999), reflecting a broader apolitical approach within the institution. A lack of data is often blamed, but we argue that such assessments profoundly reproduce the way that climate change knowledge has been dominated by a particular set of actors and framings. Leaving aside for the moment the question of whether more data will lead to more just climate responses, the lack of data in the Global South is not simply the result of inadequate climatic and environmental records. Rather, it stems from colonial histories and their continuities in current capitalist social relations that perpetuate a lack of investment in technology and infrastructure in the Global South; justice issues which are exacerbated as climate science continues to be overly invested in the Global North. Therefore, rather than pinning down exact potential impacts of climate change (i.e. more data based on existing framings) as a basis for action and justice, research attention needs to focus on the moments of concealment, how they create climate problems themselves and bring certain actors into climate governance.

Relatedly, the scaling issues raised above result in placing responsibilities for dealing with climate change (both adaptation and mitigation) on people who contribute the least to atmospheric change and as well as with the fewest resources to address it (Arora-Jonsson et al., 2016; Bezner Kerr et al., 2018). Climate justice activists and scholars have inserted some of these concerns within the global conversation (Forsyth, 2014; Ziervogel et al., 2017), but if climate justice is *co-generative* of climatic change because of how the climate problem itself is conceptualized (Goldman et al., 2018), then current attempts to redirect global resources to areas projected to be most at risk are at best woefully inadequate, and at worst risk exacerbating problems (Atteridge & Remling, 2018; Magnan et al., 2016). To address climate change and social justice, we advocate for more attention to how contemporary climate discourse co-produces inequalities in resources, and abilities to assert authoritative knowledge, control governing processes, and vulnerabilities (Scoones, 2016).

There are experiments bringing indigenous, artistic and more conventional scientific conversations together, for example, that can perhaps provide some inspiration as starting points. However, they have been criticized for failing to transform power relations in knowledge production (Beck et al., 2014; Bezner Kerr et al., 2018; Tschakert et al., 2016; van der Hel, 2016). Such attempts towards a new kind of co-production of knowledge are certainly not blue-prints; rather, they provide fodder for rethinking political and epistemological inclusion and ontological pluralism. Many of the current technologies and programmes being promoted to fulfil the Paris Agreement will not work if they do not also address these fundamental global inequalities in their design and implementation.

For these reasons, we argue that there is a need to adopt insights from social sciences and humanities concerning the co-production of how we know climate change, and the political economies, societies and biophysical change that generate it and experience it. This statement does not imply the IPCC or other climate science is misleading; just that it is insufficient. The current techno-scientific apparatus guiding our responses to climate change is deeply disempowering for most people. There is a need to acknowledge the meaning and values of how climate change is made and experienced, and to incorporate this principle into the generation of knowledge through expert organizations such as the IPCC.

Our collective failure to implement urgent action on the basis of knowing and predicting climate change outcomes warrants our conviction that profound changes are needed in how we imagine 'the climate problem'. Taking ontological plurality as a starting point, and querying the tenets of how the climate problem is framed, opens our imagination to seeing *climate change* as interlinked problems that permeate different scales and entangle socionatures in new ways. This ontological move drives us to look for research starting points not only in indigenous or local ways of knowing, but in the frictions and problematic politics that arise as different knowledges are brought to bear. For us, this is what closer engagement with the social sciences and humanities in knowledge co-production looks like. This kind of co-production goes beyond stakeholder consultation, and rather seeks to debate the norms, values and unspoken assumptions that inform all understandings of climate change. They thus cannot offer us off-the-shelf conceptual frameworks, nor can they simply offer more or richer data for on-going efforts in climate science. Rather, they drive us towards a plural approach to knowledge (Goldman et al., 2018; Nightingale, 2016), using multiple perspectives and thinking about gaps in our understanding as opportunities for imagination, querying assumptions, posing new questions, using uneven power relations to challenge hegemonies, and embracing uncertainty, rather than using the knowledge-deficit idea that the answers lie in more data or better integration.

It is urgent that we move beyond the Great Derangement, this period in history when we fail to deal with climate change, hurting people and unleashing injustices along the way through misinformed policies. Rather than striving towards what cannot be known – i.e. complete knowledge of the climate system – useful science involves exploring the significance of knowledges for our understanding of the co-emergence of climate change. Accordingly, we call for more time, consideration – and respect – to understand the meaning of climate change in diverse settings and across different perspectives. Global science has led the framing of climate change for the past decades. It is timely to consider an alternative framing which is inclusive of people and local places. This work is needed in order to enhance our comprehension of climate change as a risk, but also to motivate ourselves to take up the climate challenge more vigorously. By placing values, normative commitments, experiential and plural ways of knowing from around the world at the centre of climate knowledge, we confront climate change with contested politics and the everyday foundations of action, rather than just data.

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